SECTION 570
PORTLAND CEMENT
CONCRETE PAVEMENT REPAIR

570.01 DESCRIPTION.

This work consists of removing portions of existing Portland cement concrete pavements and adding new materials to produce a new Portland cement concrete pavement repair. This work may also include dowel bar retro-fits and grinding to restore the ride to an existing Portland cement concrete pavement. Section 550 will be applied in conjunction with this section.

570.02 MATERIALS.

A. **General.** Materials shall meet the following:

Item	Section
Portland cement concrete	802
Grouts and mortar	806
Reinforcing steel	836
Dowel bars	836

B. **Portland Cement Concrete for Repairs.** Use a 6.5 bag mix of Type I cement with a maximum water content of 5.1 gal/bag of cement for full depth repairs. Use AASHTO M–85 high early cement for spall repairs. The concrete shall be air-entrained.

C. **Joint Materials.**

1. **Concrete Joint Sealer.** The joint sealer shall be as shown on the plans unless an alternate type is approved by the Engineer before use.

2. **Fillers and Sealant.** Materials shall meet the following:

Item	Section
Preformed expansion joint filler	826.02C
Preformed expansion joint filler (Bituminous Type)	826.02D
Preformed elastomeric compression joint seal	826.02G
Hot-pour joint sealant	826.02
Silicone joint sealant	826.02B
Backer rod	826.02B1

570.03 EQUIPMENT.

Equipment shall meet the following:

Item	Section
General	151.01
PCC equipment	153

570.04 CONSTRUCTION REQUIREMENTS.

A. **General.** The notes in this section (570.04A) apply to repairs made to non-reinforced jointed PCC pavements and to continuously reinforced PCC pavements.

1. **Restoring the Subgrade.** Remove the existing concrete with minimal disturbance to the subgrade. Fill and compact voids deeper than one inch beneath the repair with granular fill as directed by the Engineer.

   Any over-depth removal not authorized by the Engineer shall be replaced and compacted with Class 5 aggregate as approved by the Engineer. The cost for any unauthorized over-depth removal and Class 5 subsequently required shall be at the Contractor's expense.

2. **Forms for PCC Repairs.** Use forms on all exposed edges. Use steel forms for full-depth repairs longer than 15 feet longitudinally. Use continuous full-depth forms of steel or two-inch-thick lumber for shorter repairs. Place forms according to Section 550.04G2.

3. **Damaged Areas.** Areas damaged (not originally designated for repair), repairs damaged during curing, and spalls occurring at full-depth repair edges when traffic is allowed on repair areas after sawcutting and before pavement removal shall be repaired at the Contractors expense.

4. **Reinforcing Steel.** Include all costs for steel reinforcing, bar supports, and tie bars in the unit price bid for full-depth repairs.

5. **Spall Repair.** Outline the spall to be repaired using a minimum 3-inch depth sawcut. Keep sawcuts beyond the patch outline to a minimum and seal them with a non-shrinking mortar material. Remove loose or unsound concrete within the outlined area (2' × 2' minimum dimensions) down at least 3 inches to sound concrete using 15-pound chipping hammers (space or other wide flat bit) and hand tools. Cut off and remove reinforcing bars discovered during the removal process. Place a form to match the patch edge to the pavement edge where the patch extends to the pavement edge.

   Sandblast the patch area. Remove all loose particles with air under pressure, directing the material away from traffic lanes. Paint the cleaned surface with an even coat of grout, placing the concrete before the grout whitens. Sandblast and regrout the patch area if any whitening occurs. Form a stiff slurry with equal parts by weight of Portland cement and fine aggregate mixed with water and apply with a stiff brush to the old concrete in a thin, even coating that does not run or puddle.

   Change the repair to full-depth if in removing the existing pavement for spall repair the engineer determines the extent of damage requires a full-depth repair. Measure the final repair limits for full payment as full-depth repair, plus measure the original repair limits for one-half the bid price for spall repair.

Pour spall repairs when air temperatures are above 40°F.

Measure and pay for spall repair by the square foot of repair area specified and accepted by the engineer. Include all costs for work performed, labor, and materials.

6. **Repair Size and Longitudinal Joint Treatment.** Place no full-depth repairs less then six feet longitudinally. Place repairs less than full panel length, using a full-depth centerline bond breaker (such as a thickness of bituthene) and no centerline steel tie. Restore the longitudinal joint but not the tie bars between the mainline and a ramp or ramp taper when the repair falls in the area of a ramp.

   Replace full-depth repairs involving both lanes, using the following centerline treatments:

   a. Fill the centerline gap between the first pour and the existing concrete with cold bituminous material to prevent water infiltration. Remove this material before the second pour. Include all costs to provide, place, and remove this material in the price bid for the full-depth repair.

   b. Treat centerline joint steel on repairs exceeding 15’ in length as follows:

      (1) Expose each half of existing bars independently and re-pour to leave the existing bar in its original location or,

      (2) Install new #5 × 2’–6” tiebars in the joint before placing the second pour to establish the original tiebar pattern and steel cross-sectional area. Install tiebars by drilling and grouting with a high-viscosity epoxy, meeting the requirements of AASHTO M-235, Class 3.

7. **Placing Portland Cement Concrete.** Place full-depth repairs the same day the concrete is removed**.** Replace full-depth repairs longer than 100 feet longitudinally within 48 hours after beginning the sawing for removal.

   Place, consolidate, finish, and cure the concrete according to Section 550 of the specifications and wet the faces of old concrete around the repair with water before placing the new concrete.

   Finish full-depth repairs longer than 15 feet longitudinally with a mechanical screed capable of providing finish and ride according to Section 550 with limited handwork required. Finish concrete flush with adjacent pavement surface. Straight edge to ensure a smooth riding surface and texture longitudinally with a carpet-type Astro Grass Drag. Check with a ten-foot straight edge before the concrete has set and correct spots 1/8 inch high or low. Correct areas not meeting surface tolerance according to Section 550.04 P.1.

8. **Longitudinal Joint Sealing.**

   Shaped the longitudinal joint reservoir 1/4-inch wide by 3/4-inch deep in areas of full-depth repairs. Clean the joint as directed by the engineer and seal with a Type I Hot Poured Elastic-Type Sealant. Include all costs for material and labor for forming or sawing, cleaning, and sealing longitudinal joints in the unit price bid for “Longitudinal PCC Joint Cleaning and Sealing.”

B. **Non-Reinforced Jointed PCC Pavement Repairs.**

1. **Existing Non-Reinforced, Jointed PCC Pavement Removal**. Saw the perimeter of the repair full depth with a diamond or carborundum blade. Make the final full-depth cut immediately after the partial-depth cuts when using more than one pass. Make transverse sawcuts parallel to existing transverse joints when fixed joints are not used on the repair. Extend transverse sawcuts (only far enough into concrete to remain) to guarantee a full-depth cut of the repair area, and seal the cut with a non-shrinking mortar material. Remove concrete by the lift-out method within 24 hours of the transverse sawing. Prepare repair edges reasonably free of the frays or spalls. Make intermediate cuts with other types of saws without penetrating the subgrade to facilitate removal.

   Include all costs for removing, hauling, and disposing of concrete and any material sticking to the removed concrete in the unit price bid for "Full-Depth Repair Items."

2. **Work Sequence.** Use the following work sequence after removing the existing PCC pavement:

   a. Perform subgrade repair, full-depth concrete pavement repair, and partial-depth spall repair simultaneously.

   b. Retrofit dowel bars if called for on the plans.

   c. Grind 12-foot driving lane, 3-foot transition in passing lane, and 3-foot transition in outside shoulder if called for on the Plans. Grind transitions after the adjacent portion of the driving lane has been ground.

   d. Clean and seal random cracks and transverse joints. Clean and seal longitudinal centerline and 10' shoulder joints.

3. **Bars for Transverse Joint at Full-Depth Repairs (Load Transfer).** Drill 1 3/8-inch maximum diameter holes at mid-depth of slab spaced as shown using rigid frame-mounted drills for proper position and alignment. Brush holes with a stiff nylon brush and blow clean with compressed air to the back of the hole. Inject a high-viscosity epoxy (meeting AASHTO M-235 Class III) into the back of the hole with a pressurized caulking apparatus. Insert 1 1/4" × 18" smooth dowel or #9 × 18" deformed Grade 40 bars, as detailed, twisting 180 degrees to 360 degrees to allow air to escape and ensure completely filled holes with bars permanently fastened to the existing concrete. Apply small form to face of hole to keep epoxy from flowing out and remove it prior to placing concrete.

   Align smooth dowel bars with the pavement direction and parallel to the plane of the surface. Lightly coat the end of each smooth dowel, extending into the patch with grease, according to Section 550.04 I.2.

   Include all costs for work, labor, and materials to install the smooth or deformed bars, as described above, in the unit price bid for "Dowel Bars."

4. **Transverse Joint Sealing at Full-Depth Repairs.** Seal smooth doweled transverse joints at full-depth repairs according to Section 550.04 M, allow-

ing traffic on the new pavement from the end of the curing period to the beginning of the joint sealing. Include all costs to form, clean, and seal smooth doweled joints in the unit price bid for "1/2–Inch Transverse PCC Joint Clean & Sealing."

Seal fixed transverse joints at full–depth repairs with Type I hot poured elastic–type joint sealant, according to Section 550.04 M. Shape the reservoir to 1/4 to 3/8-inch wide by 1 inch deep, clean as directed by the Engineer, and seal. Include all costs to form, clean, and seal fixed joints in the unit price bid for "__-Inch Concrete Pavement Repair (Full-Depth – Doweled)."

5. **Method of Measurement and Basis of Payment.**

   a. **Sawcuts.** Sawcuts will be measured by the linear foot. Measure sawcuts around the perimeter of full-depth jointed pavement repairs for payment. Include the costs for all other sawcuts in the bid item for the work being performed.

   b. **Full-Depth Repairs.** Measure full-depth concrete pavement repairs by the square yard of the area specified and accepted by the engineer. Pay for the full-depth repair quantity at the contract unit price bid.

C. **Dowel Bar Retrofit.** This work consists of retrofitting epoxy-coated bars into existing concrete pavement.

1. **Materials.**

   a. **Curing Compound**. The curing compound shall be a wax based liquid membrane–forming compound that conforms to the requirements of AASHTO M–148 (ASTM C 309) Type 1-D or 2, Class A or B.

   b. **Dowel Bars.** The Dowel bars shall be plain, round bars fabricated from steel meeting AASHTO M–31, M-42, or M-53. Dowel bars shall be cut to the required length and cleaned to remove all cutting burrs, loose mill scale, rust, grease, and oil. The bars may be sheared providing the deformation of the bars from true round shape does not exceed 0.04 inch in diameter or thickness, and shall not extend more than 0.04 inch from the sheared end.

   Dowel bars shall be epoxy-coated 100 percent on all surfaces. The epoxy coating shall be in accordance with AASHTO M-284. The dowel bars shall also be shop coated with a bond breaking release agent. The bond breaking release agent shall be a curing compound meeting the requirements specified above.

   The dowel bars shall have tight fitting end caps made of nonmetallic materials that allow for 1/4 inch movement of the bar at each end. The Contractor shall submit sample end caps to the Engineer prior to use.

   c. **Caulk.** The caulk for sealing the existing transverse joint crack at the bottom and sides of the slot shall be any commercial caulk designed as a concrete sealant that is compatible with the patch material being used.

   d. **Foam Core Board.** The foam core board shall be constructed of closed cell foam and be faced with poster board material or laminate on each side.

e. **Patching Material.** "Concrete Patch Mix" shall be Patchroc 10-60, Five Star Highway Patch, Burke 928 Fast Patch, American Highway Technology's (AHT) dowel bar retrofit mortar or an approved equal. The concrete patch mix shall be mixed and placed according to the manufacturer's recommendations.

f. **Chairs.** The chairs for supporting and holding the dowel bars in place shall be completely epoxy-coated according to Section 836.02 B, or made of nonmetallic material.

g. **Concrete Mix Design.** The Contractor shall provide the department with a concrete mix design for the patching material that meets a minimum compressive strength of 4,000 psi, in six hours, prior to the beginning of work. This mix design shall include all additives and materials that will be used on the project.

2. **Construction Requirements.** Prior to construction, the Contractor shall provide the Project Engineer with the manufacturer's product literature for usage of the patch mix.

The Contractor shall install the dowel bars in the existing concrete pavement as shown in the plans and according to the following specifications:

a. **Sawing.** Slots shall be cut in the pavement with a gang saw capable of cutting a minimum of three slots in the wheel path, at a time. The slots shall be cut to the depth required to place the center of the dowel at mid-depth in the concrete slab. Multiple saw cuts parallel to the centerline may be required to properly remove material from the slot.

b. **Jack Hammers.** Jack hammers used to remove the concrete shall not be larger than the 30-pound class.

c. **Cleaning.** All exposed surfaces and cracks in the slot shall be sand-blasted and cleaned of saw slurry and loose material before installing the dowel. All loose material will be disposed of by the Contractor off of the highway right-of-way.

d. **Dowel Bar Chair Placement.** Dowel bars shall be placed in a chair that will provide a minimum of 1/4-inch clearance between the bottom of the dowel and the bottom of the slot. The dowel bar shall be placed to the depth shown in the plans, parallel to the centerline, and parallel to pavement surface of the lower panel at the transverse joint, all to a tolerance of 1/4 inch. The chair design shall hold the dowel bar securely in place during the placement of the patch mix.

e. **Joint Caulking.** Caulk the existing transverse joint crack at the bottom and sides of the slot as shown in the plans. The transverse joint crack shall be caulked to provide a tight fit for the foam core board at the transverse joint and to prevent any of the patch mix from entering the crack at the bottom or the sides of the slot. The sealant shall not extend beyond 3/8 inch of each side of the existing transverse joint crack.

f. **Dowel Bar Placement.** The dowel bar shall be placed through the foam core board at the specified location. The dowel bar shall be placed so a

minimum of 7.0 inches is placed on either side of the transverse joint. The foam core board shall be capable of remaining in a vertical position and tight to all edges during the placement of the patch mix. If for any reason the foam core board shifts during the placement of the patch mix, the work shall be rejected and replaced at the Contractor's expense.

g. **Mixing Patch Material.** The patch material shall be mixed with a hand mixer. A metering or measuring device for the water is required. The Contractor shall assure that a consistent batch of patch mix is being produced. A mobile mixer is not acceptable.

The patching material will be tested by the Engineer at a rate of 1 test for each 4 hours of production. A minimum compressive strength of 4,000 psi in 6 hours is required. If compressive strengths are not being met, production shall cease and the contractor shall resubmit a mix design correcting the strength problems.

h. **Existing Concrete Surface Preparation.** The existing concrete surfaces inside the slotted area shall be moistened with water, using a hand sprayer immediately prior to placing the patch mix.

i. **Placing Patch Mix.** The patch mix shall be placed into the slot and vibrated with a small hand-held vibrator to ensure that the patch mix completely surrounds the dowel bar.

j. **Curing.** The surface of the patched area shall be flushed with a curing compound that meets the requirements specified above. The curing compound shall be applied within 30 seconds after a set of three dowel bar patches have been finished.

k. **Spall Repairs.** Any spalling that occurs to the transverse joints shall be repaired at the Contractors expense. The joint shall be sawed and sealed as shown in the plans.

3. **Method of Measurement and Basis of Payment.** Installation of the dowel bars will be measured and paid for as "Dowel Bar Retrofit Type B" for each dowel bar installed and accepted by the Engineer. Payment shall be full compensation for all labor, equipment, and materials necessary to complete the work as specified.

D. **Grinding.** This work consists of grinding existing PCC pavement to provide a skid resistant surface to meet smoothness requirements.

1. **Equipment.** Grinding equipment shall conform to Section 153.15.

2. **Construction Requirements.** The entire pavement surface area specified shall be ground and textured until the surface of both sides of the transverse joints and cracks are in the same plane and meet the smoothness required. Misalignment of the planes of the surfaces on the adjacent sides of the joint or crack, which are in excess of 1/16 inch, shall be ground until the surfaces are flush. The finished texture shall be uniform.

a. **Grinding Depth.** Extra depth grinding to eliminate minor depressions in order to provide texturing of all pavement surface is not required. A

minimum removal of 1/16 of an inch is required at all locations except at culverts, dips, or similar conditions. Exceptions shall be made by the engineer in the field. However, it is the intent of this specification that nearly 100 percent of the area specified is to be textured.

b. **Grinding Direction.** Grinding shall be performed in a longitudinal direction. Grinding shall begin and end at lines normal to the pavement centerline within any one ground area. The area ground shall not be left smooth or polished.

c. **Texture.** Grinding shall result in a parallel corduroy-type texture consisting of grooves between .090 and .130 inches wide. The distance between grooves shall be between .060 and .125 inches. The peaks of the ridges shall be approximately 1/16 of an inch higher than the bottom of the grooves. Adequate cross slope drainage shall be maintained.

d. **Transitions.** Auxiliary or ramp lane grinding shall transition as required from the mainline edge to provide positive drainage and an acceptable riding surface.

e. **Slope.** The transverse slope of the pavement shall be uniform to the degree that no depressions or misalignment of slope greater than 1/4 inch in ten feet exist when tested with a ten-foot straightedge. Straightedge requirements do not apply across longitudinal joints or outside ground areas.

f. **Clean-Up.** The pavement shall be left in a clean condition. The removal of all slurry or residue resulting from the grinding operation shall be continuous. The Contractor shall control the grinding operation so the residue from the operation does not flow across lanes used by traffic.

3. **Ride Quality.**

a. **Equipment.** The Contractor shall furnish and operate an approved 25-foot, California-style profilograph. The profilograph shall consist of a 25-foot frame, supported upon a multiple system of wheels at both ends. The profile shall be recorded from the vertical movement of a wheel, attached to the frame at midpoint in reference to the mean elevation of the points of contact established by the support wheels. The profilogram shall be recorded on a scale of one inch equal to 25 feet longitudinally and one inch vertically.

b. **Calibration.** Prior to pavement grinding on the project and periodically thereafter, the calibration of the profilograph shall be checked by the Contractor in the presence of the Engineer. The horizontal scale can be checked by running the profilograph over a known distance and scaling the results on the profilogram. The cause of incorrect scales shall be determined and corrected prior to using the profilograph.

c. **Operation.** The profilograph shall be operated at a speed no greater than a normal walk. Two passes shall be made in the driving lane, one in each approximate wheel path. The test wheel shall be lifted and the profilogram clearly labeled to mark the beginning and end of each trace, equa-

tions, and 500-foot markers. Each trace shall be completely labeled to show the project, stationing, lane, wheel path, date ground, date tested, and operator's name. Each tracing shall be furnished to the agency personnel prior to moving on to the next phase of work in the test area. All area(s) that need to be reground will be retested and have the retest results fastened to the original tracing.

d. **Evaluation.** After completion of grinding and texturing, the pavement surface shall have an average profile index of 0.3 inches or less in each 0.1 mile section. Individual bumps in excess of 0.3 inches in 25 feet, as measured by the profilograph, will be ground as directed by the Engineer. Evaluation consists of determining the profile index to the nearest 0.5 inches/mile by measuring and summing scallops that appear above and below a 0.2-inch blanking band. The average profile index will be determined from the two wheel paths in the driving lane.

The following areas of pavement will be exempt from the 0.3 inches in each 0.1 mile segment. 1) Pavement on horizontal curves having a centerline radius of curve less than 1,000 feet and pavement within the super elevation transition of such curves. 2) Pavement within 50 feet of the end of the project. 3) Pavement for ramps, acceleration and deceleration lanes, approaches, structure decks, city streets or county roads. 4) Pavement within 50 feet of a transverse joint that separates the pavement from a structure deck or an approach slab.

The department will spot check or retest areas it desires, with their own profilograph. If a discrepancy between the profilograms exist, the cause of the discrepancy shall be determined and the area re-run if necessary, as determined by the Engineer.

4. **Method of Measurement and Basis of Pavement.** Grinding will be measured per square yard of pavement ground and accepted by the Engineer. Payment for grinding shall be full compensation for all labor and equipment necessary to complete the work.

Pay Item	**Pay Unit**
PCC Pavement Grinding	Square Yard

5. **Joints.**

a. **One-Half Inch Transverse PCC Joint Cleaning and Sealing.** Clean and reseal the portion of the transverse joint ground. Remove existing sealant without damaging that to remain. Measure the joints cleaned and sealed by the linear foot. Regardless of joint width, include all costs for work, including sawing and backer rod when required, in the unit price bid for "1/2-Inch Transverse PCC Joint Cleaning and Sealing," "Longitudinal PCC Joint Cleaning and Sealing," and "Random PCC Crack Cleaning and Sealing."

b. **Longitudinal PCC Joint Cleaning and Sealing.** Remove existing hot pour, sandblast, and blow the joint clean, and fill with Type I hot pour. Include all costs for extra work and materials to fill varying joint widths and depths in the unit price bid for "Longitudinal PCC Joint Cleaning and Sealing."

E. **Continuously Reinforced PCC Pavement Repairs.**

1. **Existing Concrete Removal.** Saw the repair area edges with a diamond or carborundum blade as shown in the plans, leaving the edges reasonably free of frays or spalls at the pavement surface.

   Use 35-pound or smaller air hammers to avoid damage to reinforcing steel within the 18-inch lap areas and to avoid spalling at the bottom of the joint (beneath the partial-depth sawcut). Do not bend reinforcing steel which is to remain in place. Use a concrete cutter 24 inches from the partial-depth sawcut to facilitate removal. Break large areas, using a heavy ball, drop hammer, hydro-hammer, or other heavy equipment. First break a full-depth, two-foot strip along the sawcut or sawcut line with a concrete cutter, hand tools, or equipment no larger than a 35-pound air hammer. Use no heavy equipment adjacent to concrete in place less than 48 hours. Remove from the roadway and dispose of all the material off the right of way at the end of each day.

   Include all costs for sawing, concrete removal, and preparation of reinforcing steel within each two-foot end of the 12-foot-wide, full-depth repair in the unit price bid for "Full-Depth Repair – End Preparation." Include all costs of removing, hauling, and disposing of the rest of the removed concrete in the unit price bid for full-depth repair items.

2. **24-Foot-Wide, Full-Depth Repairs.** Place the first 12-foot lane at locations where both lanes are to be repaired in the following manner:

   a. Connect longitudinal rebars with mechanical splices, meeting the American Concrete Institute (ACI) Building Code for Reinforced Concrete (Chapter 12.14.3.4).

   b. Use Class AE high-early concrete with a Type A additive designed to attain 3000 psi compressive strength within 24 hours.

   c. Place Portland cement concrete between 4 p.m. and 8 p.m. with rebar connections not fully tied until within 20 minutes prior to the pour.

   d. Include all costs for sawing, concrete removal, reinforcing steel preparation, and mechanical splice rebar connections within each two-foot end of the full-depth repair (12 feet wide) in the unit price bid for "Full-Depth Repair End Prep-Mech Splice."

3. **Method of Measurement and Basis of Payment.** Full-depth continuous reinforced concrete repair shall be measured and paid for by the square yard of area specified and accepted by the Engineer at the contract unit price bid.

   Additional repair area and additional end preparation for engineer-approved extension of full-depth repairs will be measured and paid for.

570.05 METHOD OF MEASUREMENT SUMMARY.

The method of measurement for the various items in this section will be as specified in the following sections:

570.04 A 5	570.04 C 3
570.04 A 8	570.04 D 4
570.04 B 1	570.04 D 5
570.04 B 3	570.04 E 1
570.04 B 4	570.04 E 2
570.04 B 5	570.04 E 3

570.06 BASIS OF PAYMENT SUMMARY.

Pay Item	**Pay Unit**
PCC Pavement Grinding	SY
Doweled Contraction Joint Assembly	LF
Dowel Bars	EA
Dowel Bar Retrofit – Type BEA	
Full-Depth Repair – End Prep – Mech Spine	EA
Full-Depth Repair – End Preparation	EA
__–Inch Concrete Pavement Repair – Full-Depth Doweled	SY
__–Inch Concrete Pavement Repair – Full-Depth Continuous	SY
1/2-Inch Transverse PCC Joint Cleaning & Sealing	LF
Contraction Joint Silicone Seal	LF
Longitudinal PCC Joint Cleaning & Sealing	LF
Random PCC Crack Cleaning & Sealing	LF
Spall Repair – Partial-Depth	SF
__ -Inch Full-Depth Sawcuts	LF